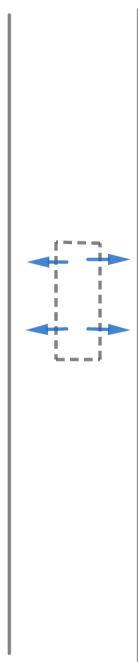


2019B F=ma Exam: Problem 6

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Recall from Gauss's law of gravity that the gravitational flux through a closed surface is proportional to the mass enclosed:

$$\Phi_g = -4\pi G M_{enc}$$

Within an infinite cylinder of uniform density, we consider a cylindrical Gaussian surface,

$$\Phi_g = g(2\pi r h)$$

$$M_{enc} = \rho(\pi r^2 h)$$

so

$$g(2\pi r h) = -4\pi G \rho(\pi r^2 h)$$
$$g \propto r$$

Note that centripetal acceleration

$$a_c = \omega^2 r$$
$$a_c \propto r$$

so for gravity to provide the centripetal force, the density of the dust doesn't depend on r . Thus, the answer is C.